



In re: Sang-bom Kang et al.

Serial No.: 10/050,195

Filed: January 16, 2002

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In the Claims:

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1. (Currently Amended) An integrated circuit device, comprising:
a substrate;
an insulating layer disposed on the substrate having a gap formed therein;
a liner layer that exhibits compressive stress characteristics disposed on sidewalls of the insulating layer, which define the gap, and on the substrate in the gap; and
a contact plug that exhibits tensile stress characteristics disposed directly on the liner layer.
2. (Original) The integrated circuit device of Claim 1, wherein the liner layer and the contact plug comprise titanium nitride (TiN).
- B 3. (Currently Amended) The integrated circuit device of Claim 1, wherein the liner layer has an amorphous ~~crystal~~ structure.
4. (Original) The integrated circuit device of Claim 1, further comprising:
an ohmic layer disposed between the liner layer and the sidewalls of the insulating layer, and between the liner layer and the substrate.
5. (Original) The integrated circuit device of Claim 4, wherein the ohmic layer comprise titanium (Ti).
6. (Original) The integrated circuit device of Claim 4, wherein the ohmic layer has a thickness of about 70 Å - 100 Å.
7. (Original) The integrated circuit device of Claim 1, wherein the liner layer has a thickness of about 200 Å - 500 Å.

8. (Original) The integrated circuit device of Claim 1, further comprising:
a wiring layer disposed on an upper surface of the contact plug opposite the substrate.

9. (Original) The integrated circuit device of Claim 1, wherein the wiring layer
comprises a metal material.

10. (Original) The integrated circuit device of Claim 1, wherein the wiring layer
comprises at least one of tungsten (W) and aluminum (Al).

11. (Original) The integrated circuit device of Claim 1, further comprising:
a capacitor disposed on an upper surface of the contact plug opposite the substrate.

12. (Currently Amended) The integrated circuit device of Claim 11, wherein the
capacitor comprises a lower electrode that contacts the upper surface of the contact plug.

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13. (Original) The integrated circuit device of Claim 12, wherein the lower
electrode comprises at least one of the following materials: W, Pt, Ru, Ir, TiN, TaN, WN,
RuO₂, and IrO₂.

14. (Currently Amended) The integrated circuit device of Claim 1, wherein the
gap is wider at a surface of the insulating layer opposite the substrate than ~~it~~ the gap is at
another location.

15. (Cancelled)

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)

19. (Cancelled)

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Cancelled)

24. (Cancelled)

25. (Original) A contact plug of a semiconductor device formed through an insulating film interposed between a lower conductive layer and an upper conductive layer to electrically connect the lower conductive layer to the upper conductive layer, comprising:

a TiN plug having an upper surface contacting the upper conductive layer and having tensile stress;

a TiN liner contacting the TiN plug so as to surround the TiN plug along the side wall and the bottom of the TiN plug and having compressive stress; and

an ohmic layer contacting the TiN liner on the opposite side of the TiN plug and located between the TiN liner and the insulating film and between the TiN liner and the lower conductive layer.

26. (Original) The contact plug of Claim 25, wherein the TiN plug comprises a

TiN film formed by chemical vapor deposition (CVD), atomic layer deposition (ALD), metal organic CVD (MOCVD), or metal organic ALD (MOALD).

27. (Original) The contact plug of Claim 25, wherein the TiN liner comprises a TiN film formed by ionized physical vapor deposition (IPVD), metal organic CVD (MOCVD), metal organic ALD (MOALD), sputtering, or collimator sputtering.

28. (Original) The contact plug of Claim 25, wherein the TiN liner has an amorphous structure.

29. (Original) The contact plug of Claim 28, wherein the TiN liner comprises a TiN film formed by ionized physical vapor deposition (IPVD).

30. (Original) The contact plug of Claim 25, wherein the TiN plug has a bottom surface, which contacts the TiN liner, and the upper surface of the TiN plug has a width greater than the width of the bottom surface.

31. (Original) The contact plug of Claim 25, wherein the upper conductive layer comprises at least one film selected from the group of films consisting of W, Al, Pt, Ru, Ir, TiN, TaN, WN, RuO₂, and IrO₂.

32. (Currently Amended) The contact plug of Claim 25, wherein the upper conductive layer comprises ~~the~~ a lower electrode of a capacitor.

33. (Cancelled)

34. (Cancelled)

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35. (Cancelled)

36. (Cancelled)

37. (Cancelled)

38. (Cancelled)

39. (Cancelled)

40. (Cancelled)

41. (Cancelled)

42. (Cancelled)

43. (Cancelled)

44. (Cancelled)

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